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Abstract of th Disclosur

The several embodiments of the invention include digitally tunable laser source, add-drop and cross connect devices, a tapered waveguide, a lensed waveguide, an asymmetric waveguide pair, a temperature sensor, and a tunable laser array, as well as methods for making and tuning these devices. The laser source, add-drop, and cross connect devices include materials with negative dependence of refractive index on temperature and temperature independent coincidence between resonator modes and a set of specified frequencies, e.g. for DWDM telecommunications channels. The free spectral range may be adjusted to equal a rational fraction of the specified frequency interval. The operating frequency may be selected by a thermo-optically tuned feedback element without substantially tuning the cavity modes. This can be accomplished by means of a waveguide pair with differential thermal response. The operating frequency may be induced to hop digitally between the specified frequencies. In a particular embodiment, semiconductor amplifier and polymer waveguide segments form a linear resonator with a thermo-optically tuned grating reflector. In a further embodiment, an amplifier and two waveguides from a tunable grating assisted coupler form a ring resonator. Tuning may also be accomplished by applying an electric field across a liquid crystal portion of the waveguide structure within the grating. The differential waveguide pair may also be used as a temperature or electric field sensor, or it may be used in a waveguide array to adjust a phase relationship, e.g. in an arrayed waveguide grating. A tapered waveguide may be used to couple different size waveguides, e.g. in a resonator having both a semiconductor diode amplifier wav guide and a planar waveguide structure for coupling to an optical fiber. A lensed planar waveguide may be used to couple to a different size wav guide, e.g. a semiconductor diode amplifier waveguid .

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